

Remarks

Reconsideration and reexamination of the above-identified patent application, as amended, are respectfully requested. Claims 1 and 3-5 are pending in this application upon entry of this Amendment. In this Amendment, the Applicant has amended claims 1 and 3; and cancelled claim 2. No claims have been added in this Amendment. Of the pending claims, claim 1 is the only independent claim.

Claim Rejections - 35 U.S.C. § 103

In the Office Action mailed July 2, 2004, the Examiner rejected claims 1-3 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,405,694 issued to Sato ("Sato") in view of U.S. Patent No. 6,478,000 issued to Ishii et al. ("Ishii"). The Applicant believes that the claimed invention is patentable over any combination of Sato and Ishii and has amended independent claim 1 to more clearly define thereover.

1. The Claimed Invention

The inventors of the claimed invention determined the following first piece of information: (1) responsibility of variable intake phase mechanisms (namely advancing hydraulic chambers and retarding hydraulic chambers) changes based on amounts of hydraulic fluids that leak from annular grooves provided on the camshaft bearing surfaces of a cam cap. The inventors of the claimed invention also determined the following second piece of information: (2) when an accelerator pedal is returned from a load state to an idling state wherein the overlap period of the intake and exhaust valves is large, the intake air amount becomes least because the throttle valve is closed, and therefore the overlap period needs to be promptly changed to be small so as not to obtain unstable combustion that causes an engine stall.

The inventors thereafter made the claimed invention based on the determined first and second pieces of information. Namely, as set forth in amended independent claim 1, the annular groove for retarding on the intake camshaft bearing surface and the annular groove for advancing on the external camshaft bearing surface are respectively provided in the center in the width direction of their respective bearing surfaces so that the hydraulic fluids in these annular grooves are respectively less susceptible from leaking out from these respective annular grooves. Further, as set forth in amended independent claim 1, the annular groove for advancing on the intake camshaft bearing surface and the annular groove for retarding on the exhaust camshaft bearing surface of the cam cap are respectively provided near the edges of their respective bearing surfaces in the width direction so that the hydraulic fluids in these annular grooves are respectively more susceptible to leak out from these respective annular grooves. As a result, the phases of the camshafts are retarded promptly on the intake side and advanced promptly on the exhaust side so as to obtain a stable combustion not causing an engine stall when the accelerator pedal is returned from the load state to the idling state.

2. Sato and Ishii

Sato discloses in FIG. 2 that the advance angle groove 46 and the retard angle groove 47 for the exhaust side variable valve timing device 20 are both provided in the center in the width direction of the bearing surface.

Ishii discloses in FIG. 2 that the timing advance-side oil passage 47 for the variable intake phase mechanism 24 is provided in the center in the width direction of the surface of the bearing 15a, and that the timing retard-side oil passage 48 for the variable intake phase mechanism 24 is provided near the edge of the surface of the bearing 15a.

The Applicant respectfully submits that the positions of oil passages 47, 48 in Ishii are completely reverse to those positions of the claimed invention as indicated by the Examiner in the Office Action. Significantly, Ishii does not disclose the reason why these positions of the oil passages 47 and 48 are employed. Moreover, Ishii does not teach or

suggest that the leakage of hydraulic fluid (or oil) from an annular groove is largely dependent upon how promptly the overlap period of the intake and exhaust valves are changed from large to small when the accelerator pedal is returned from a load state to an idling state.

3. The Claimed Invention Compared to the Cited Prior Art

Sato and Ishii, alone or in combination, do not teach or suggest the first and second pieces of information determined by the inventors for use in making the claimed invention set forth in amended independent claim 1. That is, Sato and Ishii, alone or in combination, do not teach or suggest: (a) the annular groove for retarding on the intake camshaft bearing surface and the annular groove for advancing on the external camshaft bearing surface being respectively provided in the center in the width direction of their respective bearing surfaces so that the hydraulic fluids in these annular grooves are respectively less susceptible from leaking out from these respective annular grooves; and (b) the annular groove for advancing on the intake camshaft bearing surface and the annular groove for retarding on the exhaust camshaft bearing surface of the cam cap being respectively provided near the edges of their respective bearing surfaces in the width direction so that the hydraulic fluids in these annular grooves are respectively more susceptible to leak out from these respective annular grooves; such that (c) the phases of the camshafts are retarded promptly on the intake side and advanced promptly on the exhaust side so as to obtain a stable combustion not causing an engine stall when the accelerator pedal is returned from the load state to the idling state.

Therefore, the Applicant believes that amended independent claim 1 is patentable under 35 U.S.C. § 103(a) over Sato and Ishii. Claim 3 depends on amended independent claim 1 and includes the limitations therein. Thus, the Applicant respectfully requests reconsideration and withdrawal of the rejection to claims 1 and 3 under 35 U.S.C. § 103(a) in view of Sato and Ishii.

The Examiner rejected claim 4 under 35 U.S.C. § 103(a) as being unpatentable over Sato in view of Ishii as applied to claim 1 above, and further in view of U.S. Patent No. 6,516,759 issued to Takahashi et al. ("Takahashi"). Takahashi discloses that the exhaust valve side actuator 16 is provided with a spring (not shown) for urging vanes 152 in an angle advancing direction in order to offset a reactive force of the camshaft. However, claim 4 depends from amended independent claim 1 and Takahashi does not disclose the claimed features in amended independent claim 1. As such, the Applicant believes that claim 4 is patentable under 35 U.S.C. § 103(a) over Sato, Ishii, and Takahashi.

The Examiner rejected claim 5 under 35 U.S.C. § 103(a) as being unpatentable over Sato in view of Ishii as applied to claim 1 above, and further in view of U.S. Patent No. 6,289,861 issued to Suzuki ("Suzuki"). Suzuki discloses two grooves spaced equally on the intake camshaft 34 in Figure 4. Suzuki further discloses supply passages 64, 65 and exhaust passages 72, 73. However, Suzuki does not teach or suggest how these passages correspond to "an intake-side advancing hydraulic line" and "an intake-side retarding hydraulic line" as set forth in amended independent claim 1. Further, claim 5 depends from amended independent claim 1 and Suzuki does not disclose the claimed features in amended independent claim 1. As a result, the Applicant believes that claim 5 is patentable under 35 U.S.C. § 103(a) over Sato, Ishii, and Suzuki.

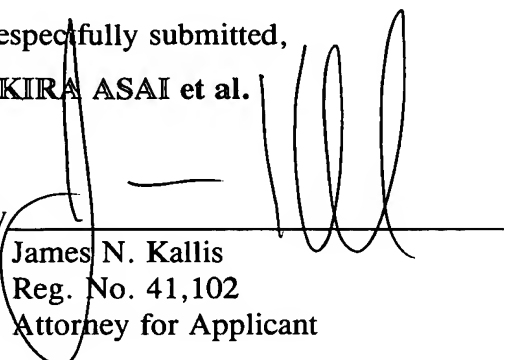
CONCLUSION

In summary, claims 1 and 3-5, as amended, meet the substantive requirements for patentability. The case is in appropriate condition for allowance. Accordingly, such action is respectfully requested.

If a telephone or video conference would expedite allowance or resolve any further questions, such a conference is invited at the convenience of the Examiner.

Respectfully submitted,
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